IS 7006 (1973): Visual Acuity Test Charts [MHD 5: Ophthalmic Instruments and Appliances]

BLANK PAGE

IS : 7006 - 1973
(Reaffirmed 2002)

Indian Standard

SPECIFICATION FOR VISUAL ACUITY TEST CHARTS

UDC 617·751 — 072·7

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110001

Price Rs 5·50

January 1974

Indian Standard

SPECIFICATION FOR VISUAL ACUITY TEST CHARTS

Optical and Mathematical Instruments Sectional Committee, EDC 36

Chairman

DR C. S. RAO

Kailas, Frenchpet, Machilipatnam

Members	*Representing*
SHRI A. ALVARES	All India Instrument Manufacturers and Dealers Association, Bombay
SHRI V. K. VASUDEVAN (*Alternate*)	
SHRI A. N. BHATTACHARYA	Ministry of Defence (R & D)
SHRI J. CHATTERJEE	Survey of India, Dehra Dun
CHIEF HYDROGRAPHER (NAVY)	Naval Headquarters
DEPUTY DIRECTOR, STANDARDS (TRACK)	Research, Designs and Standards Organisation (Ministry of Railways), Lucknow
ASSISTANT DIRECTOR, STANDARDS (TRACK) (*Alternate*)	
DIRECTOR, INSTRUMENTS RESEARCH & DEVELOPMENT ESTABLISHMENT	Ministry of Defence (R & D)
SHRI S. S. DHARMAYYA (*Alternate*)	
SHRI S. K. GAUTAM	Quality Marked Goods Manufacturers' Co-operative Association Ltd, Roorkee
SHRI P. L. BHARDWAJ (*Alternate*)	
SHRI S. K. GHOSE	Directorate General, Ordnance Factories, Ministry of Defence
SHRI A. GHOSH	National Test House, Calcutta
SHRI P. C. JAIN	National Physical Laboratory (CSIR), New Delh
SHRI RAM PRASAD (*Alternate*)	
SHRI D. D. KHOSLA	Directorate of Industries, Government of Haryana, Chandigarh
COL K. L. KHOSLA	The Institution of Surveyors, New Delhi
COL N. P. MANAKTALA	Ministry of Defence (DGI)
LT-COL H. LAL (*Alternate*)	
SHRI B. R. MANKHAND	The Koh-I-Noor (India) Private Limited, Varanasi
DR M. V. R. K. MURTY	Department of Atomic Energy, Bombay
LT-COL B. PAPANNA	Army Headquarter

(*Continued on page* 2)

(*Continued from page* 1)

Members	*Representing*
DR J. PRASAD	Central Scientific Instruments Organization (CSIR), Chandigarh
SHRI RAM SINGH (*Alternate*)	
SHRI S. RAGHVIAH	Development Commissioner, Small Scale Industries, New Delhi
SHRI E. B. RAJDERKAR	Raj-Der-Kar & Co, Bombay
KUMARI SUBAS RAJDERKAR (*Alternate*)	
SHRI K. N. RAMASWAMY	Directorate General of Technical Development, New Delhi
SHRI P. V. MAMMEN (*Alternate*)	
SHRI C. NARAYANA RAO	The Andhra Scientific Co Ltd, Masulipatam
DR I. RAMAKRISHNA RAO	In personal capacity (*Toshniwal Instruments and Engineering Co, 10A, Najafgarh Road, New Delhi*)
PROF G. S. S. SARMA	Madras Institute of Technology, Madras
LT-COL G. S. SIHOTA	Directorate General of Armed Forces Medical Service, Ministry of Defence
SURVEYOR OF WORKS I [OFFICE OF THE SUPERINTENDING SURVEYOR OF WORKS (NDZ)]	Central Public Works Department, New Delhi
SHRI K. G. TORGAL	The National Instruments & Ophthalmic Glass Ltd, Calcutta
SHRI A. GHOSH (*Alternate*)	
SHRI H. C. VERMA	Associated Instrument Manufacturers (India) Private Limited, New Delhi
SHRI K. G. PURANG (*Alternate*)	
SHRI S. M. RAZVI, Head (Mech Engg)	Director General, ISI (*Ex-officio Member*)

Secretary

SHRI S. P. ABBEY

Assistant Director (Mech Engg), ISI

Medical Optical Instruments Subcommittee, EDC 36 : 6

Convener

*SHRI S. S. DHARMAYYA	Ministry of Defence (R & D)

Members

DR LALIT P. AGARWAL	All India Institute of Medical Sciences, New Delhi
SHRI A. K. CHAKI	The National Instruments & Ophthalmic Glass Ltd, Calcutta
SHRI H. K. DAS (*Alternate*)	

(*Continued on page* 14)

*He is also alternate to Director, Instruments Research & Development Establishment.

Indian Standard

SPECIFICATION FOR VISUAL ACUITY TEST CHARTS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 21 June 1973, after the draft finalized by the Optical and Mathematical Instruments Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 Visual acuity test charts are used to determine visual acuity at different distances. These are of four types out of which the first one employs 18 English (Roman) capital letters; the second one includes 19 Hindi alphabets selected from the Devanagari script approved by the Government of India; the third one, known as 'illiterate' chart, includes the single letter E; and the fourth one known as Landolt ring chart, includes the single letter C (Landolt or broken ring). Single letters E and C are printed in various orientations.

0.3 The visual acuity denoted by 6/6 is normal. Although in some cases this value is as good as 6/3, inclusion of only one more line smaller than the 6 metre line has been recommended.

0.4 Visual acuity is considerably affected by the luminance of an object and its background to certain extent. Due to this reason, requirements of providing internal and external illuminations for these charts have been given in this standard which will be useful for the manufacturers and the practitioners of the chart.

0.5 When test charts are used for scientific purposes they shall be viewed from a distance of 6 metres under illumination as recommended in this standard, and the visual acuity shall be expressed as 6/X. The letter C (indicating a Landolt ring chart) or E (indicating an illiterate E chart) shall be added if one of these charts is used, since neither of the two is exactly equivalent to a letter chart.

0.6 While preparing this standard, assistance has been derived from BS 4274 : 1968 'Specification for test charts for determining distance visual acuity', issued by British Standards Institution.

1. SCOPE

1.1 This standard specifies the basic requirements of four types of visual acuity test charts designed for either internal or external illumination.

2. TERMINOLOGY

2.0 For the purpose of this standard, the definitions given in IS : 1399-1959* and the following definitions shall apply:

2.1 Letter Size — The different distances marked on a chart in metres at which the height of the letter subtends an angle of 5 minutes of arc.

2.2 Unit Length — The linear distance subtending an angle of one minute of arc at the distance indicated by the letter size.

2.3 5 × 5 Letter — A letter which may be framed tengentially by a square 5 unit lengths in height and width.

2.4 5 × 4 Letter — A letter which may be framed tangentially by a rectangle 5 unit lengths in height and 4 unit lengths in width.

2.5 Luminance Contrast — It is defined as the ratio $\frac{B_1 - B_2}{B_1 + B_2}$, where B_1 is the luminance of the white background and B_2 is the luminance of the test letter.

3. CHART SIZE

3.1 All the four types of visual acuity test charts, namely, the literate English chart, the Hindi chart, the illiterate E chart, and the chart containing Landolt ring C shall be printed as indicated in Table 1. Each chart shall contain 8 lines of letters/symbols having the dimensions indicated in Table 1.

4. GENERAL REQUIREMENTS

4.1 Printing

4.1.1 The charts shall be flat and rectangular in shape. The printed side shall be smooth and even, and shall be free from spots.

4.1.2 The printing shall be in black colour on a white background. The ink shall be evenly spread such that inked surfaces are free from spots and other defects.

4.1.3 The workmanship and finish of the chart shall be of high quality.

*Glossary of terms used in optical technology.

TABLE 1 SIZES OF LETTERS AND LINES

(*Clauses* 3.1, 4.3.2 *and* 4.4.1)

LETTER/SYMBOL SIZE	NO. OF LETTERS/ SYMBOLS PER LINE	LINEAR HEIGHT OF LETTERS/SYMBOLS	LENGTH OF EACH LINE
(1)	(2)	(3)	(4)
		mm	mm
60	1	87·3	
36	2	52·4	
24	3	34·9	
18	4	26·2	140+10·0 −0
12	5	17·5	
9	6	13·1	
6	7	8·7	
5	8	7·3	

NOTE 1 — The first letter/symbol of each line shall start at the same distance from vertical edge of the chart except the top letter/symbol size 60.

NOTE 2 — The letter/symbol marked 60 shall be written in the centre of the chart.

NOTE 3 — The length of all the lines in the chart shall be the same. The letters/ symbols in each line shall be equally spaced.

4.2 Type and Selection of Letters

4.2.1 The English chart shall employ 18 capital letters, namely, A, B, C, D, E, F, H, J, K, L, N, O, P, T, U, X, Y and Z. The Hindi chart shall employ the following 19 letters:

अ फ क ग घ ल ष ज ट ठ

ण न द प र व त म स

4.2.1.1 The letters used shall be of non-serif type.

4.2.2 Except on Landolt ring C chart and illiterate E chart no letter shall be repeated an any one line of the chart or repeated more than twice on the entire chart.

4.2.3 Letters may be reversed for indirect viewing in a mirror.

4.3 Letter Sizes and Dimensions

4.3.1 The letter size shall be indicated by figures having maximum height of 3 mm placed below the centre of each line of letters.

4.3.2 The number of letters/symbols in different lines, their linear heights, and the length of each line at different letter/symbol sizes shall conform to Table 1.

4.3.3 The letters employed in English chart shall be of 5×4 unit size, while those in the Hindi chart, the illiterate E chart and the Landolt ring C chart shall be of 5×5 unit size, the thickness of each letter/symbol being of 1 unit size, and the clean space between parallel lines in a letter being 1, 2 or 3 unit lengths as appropriate.

4.3.4 In case of Landolt ring chart, the overall diameter of each broken ring shall be 5 unit lengths, the line width being 1 unit length. The length of the break shall be 1 unit, the break being placed in one of the four positions, namely, top, bottom, right or left. In case of more than one ring in the same line, all of these four orientations shall be used as far as possible.

4.3.5 In case of illiterate E charts, the overall length of the middle bar shall be 4 unit lengths. The open side of the 'E' shall be placed in one of the four positions, namely, top, bottom, right or left. In case of more than one 'E's in the same line, all of these four orientations shall be used as far as possible.

4.3.6 In no case the spaces between different lines/portions of a letter shall be less than 1 unit length.

4.3.7 All dimensions specified in this standard shall be subject to a manufacturing tolerance of ± 5 percent or 0·25 mm, whichever is less.

4.4 Spacing of Letters and Lines

4.4.1 The letters on any one line shall be evenly spaced. The spacing can be known from Table 1.

4.4.2 There shall be a clear space of at least 25 mm between successive lines of letters/symbols on the chart. There shall also be a margin of atleast 25 mm on all sides of the chart.

4.5 Illumination

4.5.1 In case of internally illuminated charts, which are supplied in a cabinet or fixture incorporating a system of lighting, the letter shall comply with all the relevant requirements of Appendix A.

4.5.2 The lighting arrangements for externally illuminated charts shall conform to Appendix B. These shall act as guide to users.

5. FUNCTIONAL REQUIREMENTS

5.1 The letters shall appear well defined when seen under illuminations recommended in Appendices A and B.

5.2 When measured, the luminance contrast shall not be less than 0·9.

6. TESTS

6.0 Each type of chart shall be subjected to the following tests:

6.1 Dimensions

6.1.1 All the dimensions shall be measured with a suitable vernier scale or a measuring (travelling) microscope. The measured values shall not differ from the specified/calculated values by more than the tolerances indicated in **4.3.7**.

6.1.2 The angles subtended by the heights and the line thicknesses of different letters and rings shall be measured at specified distances with the help of a suitable theodolite. The measured values shall be 5 and 1 minutes respectively subject to the tolerances specified in **4.3.7.**

6.1.3 The angles subtended by the various spaces between different lines/portions of a letter shall also be measured as above and the measured values shall, in no case, be less than 1 minute.

6.2 Luminance Contrast—It shall be determined with the help of a suitable photometer. The chart shall be illuminated and any test letter (preferably a letter having any of its constituent lines horizontal) or ring (in case of Landolt ring chart) shall be chosen for this purpose. The aperture of the photometer shall be adjusted in such a way that it is slightly less than the thickness of the line concerned. The photometer shall be kept at a fixed distance from the chart and moved before the line to such an extent that sometimes it purely faces the line and sometimes purely its background. The maximum reading of the photometer shall be noted and denoted by B_1. This will actually correspond to the position when the photometer is purely before the white background. Similarly the minimum reading of the photometer shall also be noted and denoted by B_2. This will correspond to the position when the photometer is purely before the black line of the test letter. The luminance contrast shall be calculated by the formula given in **2.6**. This value shall conform to the value specified in **5.2**. At least one such measurement shall be made in each line of the chart.

7. MARKING

7.1 Each chart shall be legibly and indelibly marked with the following:

a) Type of the chart;
b) Manufacturer's name or trade-mark; and
c) Year of manufacture, if required.

7.1.1 The chart may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

8. PACKING AND PACKAGING

8.1 The charts shall be delivered in thoroughly neat and clean condition.

8.2 Each chart shall individually be wrapped in tissue paper.

8.3 The charts shall then be suitably packed in boxes.

8.4 Charts supplied in a cabinet or fixture, incorporating a system of internal illumination, shall be well packed using cushioning materials so as to avoid any damage to the cabinet or the illumination system.

8.5 Each package shall be marked with the description and the number of contents. The package referred to in **8.4** shall also be marked with the standard symbol for indicating fragile contents and the symbol for 'THIS WAY UP' according to IS : 1286-1967* together with the legend 'HANDLE WITH CARE' in red.

APPENDIX A

(*Clauses* 4.5.1 *and* 5.1)

GENERAL RECOMMENDATIONS ON LIGHTING FOR TEST CHARTS

A-1. PHOTOMETRIC UNITS

A-1.1 The units adopted here are the internationally accepted system of metric unit known as SI units.

A-1.2 The SI unit of luminance is the candela per square metre (cd/m^2).

A-1.3 The SI unit of illumination is the lux (lx).

A-2 LEVEL OF LUMINANCE OR ILLUMINATION

A-2.1 Internally Illuminated Charts — Visual acuity increases considerably with luminance up to about 120 cd/m^2 to 140 cd/m^2 above

*Pictorial markings for handling of goods in general (*first revision*).

which level the rate of improvement becomes insignificant. There is hence a good case for setting the lower limit at 120 cd/m² but little point in setting an upper limit.

A-2.2 Externally Illuminated Charts — The luminance of a uniformally diffusing surface is governed by the illumination falling on it and the reflection factor of the surface. On the assumption of a reflection factor of 0·8, the level of illumination for externally lit charts shall not be less than 480 lux to obtain the desired minimum luminance of 120 cd/m². This agrees with the figure of 45 lm/ft² (480 lux) recommended in the I.E.S. Code*.

A-2.3 Maintenance Factor — According to the usual practice followed in illuminating engineering, the desired minima should be increased by 25 percent for new equipment so as to allow for the deterioration of lamps and equipment with age. The figures so amended are summerized in Table 2.

A-3. EVENNESS OF LUMINANCE OR ILLUMINATION

A-3.1 Local variation can be expressed in terms of the uniformity ratio, that is, the ratio of the minimum to the maximum value of the background luminance. In general lighting schemes a minimum figure of 70 percent is considered desirable, and this shall apply to test charts (*see* Table 2).

A-4. LUMINANCE OF SURROUND AND ROOM ILLUMINATION

A-4.1 It is generally accepted that in order to obviate discomfort due to glare the luminance of the immediate surround should not fall below 30 percent and the luminance of the general surround not below 10 percent of that of the test chart. This is for prolonged observation. For the purpose of testing the visual acuity a figure of 30 percent for the immediate surround is unnecessarily high and would be unrealistic. Nevertheless, the 10 percent minimum level should be exceeded whenever possible, particularly when the luminance of the chart itself is well above the recommended minimum.

With externally illuminated charts the immediate surround is often adequately lit by spillage from the chart lamps, but subsidiary lighting may be needed with any type of the charts. To achieve an adequate level of surround luminance light-toned decorations are as important as the lighting itself.

The state of adaptation of the eye also affects acuity, and this is an additional reason for recording visual acuity under general room illumination.

*Recommendations for good interior lighting (Illuminating Engineering Society, London, 1961).

TABLE 2 SUMMARY OF RECOMMENDATIONS ON LIGHTING FOR TEST CHARTS

(*Clauses* A-2.3 *and* A-3.1)

QUANTITY	DESIRED MINIMUM	MINIMUM FOR NEW EQUIPMENT
(1)	(2)	(3)
Minimum luminance (internally illuminated charts)	120 cd/m^2	150 cd/m^2
Minimum illumination (externally illuminated charts)	480 lx	600 lx
Minimum uniformity ratio	70 percent	70 percent

APPENDIX B

(*Clauses* 4.5.2 *and* 5.1)

SIMPLE METHODS OF LIGHTING FOR EXTERNALLY ILLUMINATED CHARTS

B-0. GENERAL

B-0.1 These notes are intended for the guidance of practitioners using externally illuminated charts.

B-1. METHODS

B-1.1 The minimum level and uniformity of illumination recommended in Appendix A can be achieved by a number of different arrangements, four simple examples of which are outlined below. Exact figures for illumination and uniformity cannot be given for any of these arrangements because much will depend on the reflectors or screens used with the lamps. There may, in addition, be variations between lamps of the same wattage. In general, however, the results shall be found satisfactory.

Method 1. Two General Lighting Service Lamps — This method requires two 60 watt lamps of the familiar domestic type. They may be 'pearl' or 'opalized', the latter may be completely opalized or have (in a more recent variety) a pearl crown which results in a more directional illumination.

The lamps shall be mounted as shown in Fig. 1 about 35 cm in front of the chart, just above and below it in a vertical plane through the centre of the chart, the axis of each lamp being inclined at about 15 degrees from the horizontal.

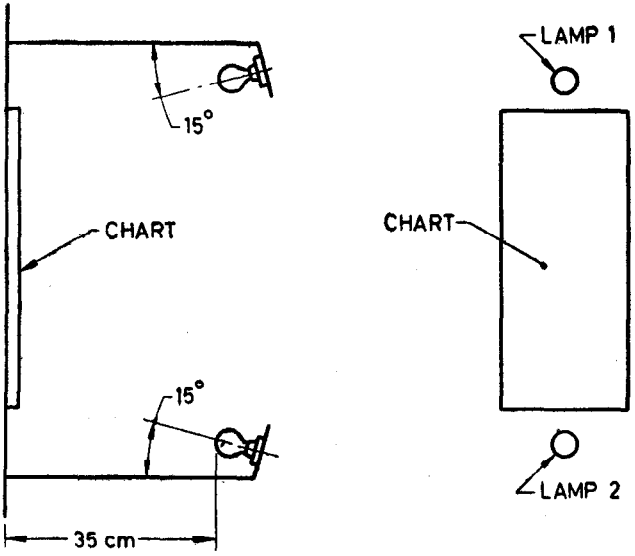


FIG. 1 LIGHTING FOR EXTERNALLY ILLUMINATED CHARTS—METHOD 1

Method 2. Two Tubular Fluorescent Lamps—This method requires two 40 watt tubular fluorescent lamps. They shall be mounted as shown in Fig. 2 up to 60 cm apart and about 30 cm each from the plane of the chart.

Method 3. One Reflector Spotlight Lamp—This method requires one 100 watt lamp of the reflector spotlight type, mounted in front of the chart and about 150 cm away from it with as little obliquity as possible (*see* Fig. 3). Care shall be taken to orientate and mount the lamp in such a way that the most intense part of the beam, roughly elliptical in shape, adequately covers the chart.

Method 4. Lighting Arrangement for Two Charts—This lighting arrangement, comprising a cabinet and four lamps, is designed for two charts mounted side by side, but can be modified to suit one chart.

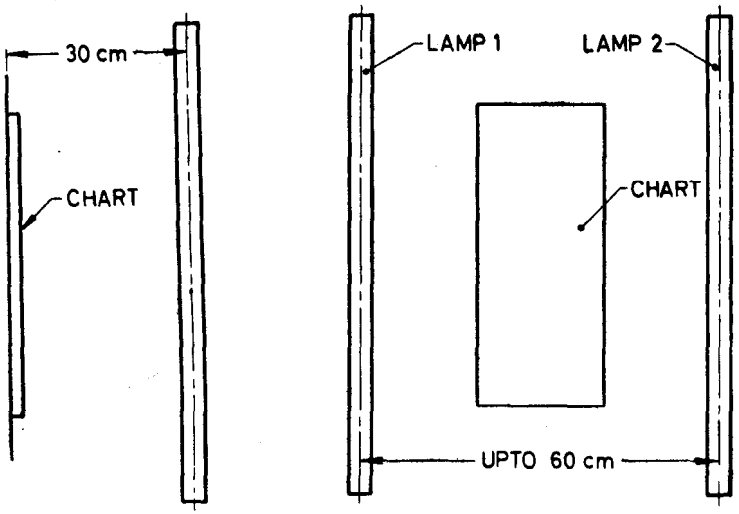
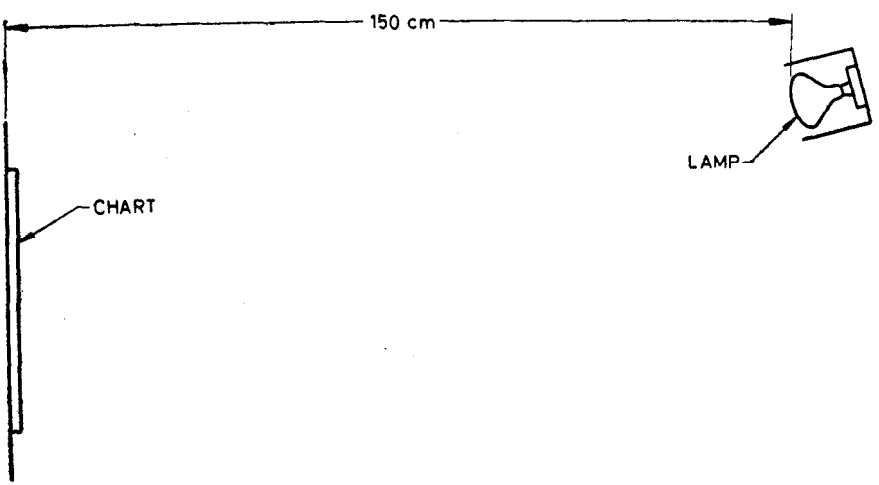


FIG. 2 LIGHTING FOR EXTERNALLY ILLUMINATED CHARTS—METHOD 2



PLAN OR SIDE VIEW

FIG. 3 LIGHTING FOR EXTERNALLY ILLUMINATED CHARTS—METHOD 3

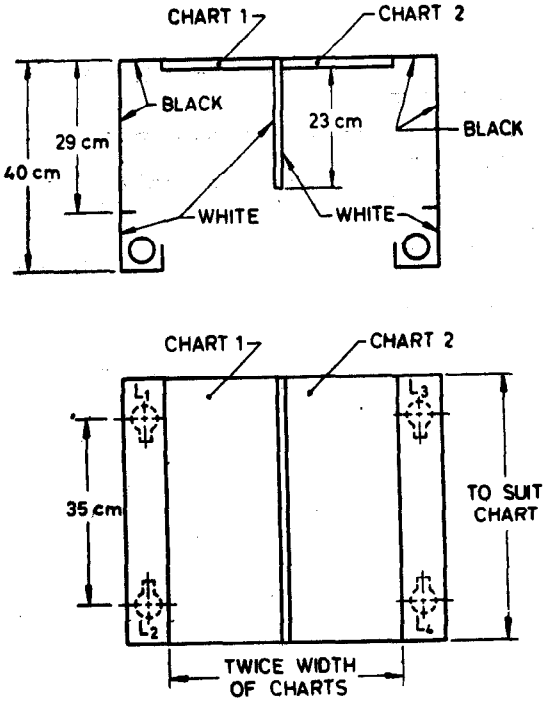


FIG. 4 LIGHTING FOR EXTERNALLY ILLUMINATED CHARTS—METHOD 4

The main construction of the cabinet is shown in Fig. 4. A special feature is the white septum placed between the two charts, designed to screen the right-hand chart from the left-hand lamps (and *vice versa*) and, by acting as a reflector, to make the illumination on each chart more uniform.

The lamps shall be of 40 watt either of pearl or opal and the inside of the cabinet shall be painted white or black as indicated in the figure.

(*Continued from page* 2)

Members	*Representing*
DIRECTOR, INSTRUMENTS RESEARCH & DEVELOPMENT ESTABLISHMENT	Ministry of Defence (R & D)
SHRI H. C. MUKHERJEE	Ministry of Defence (DGI)
SHRI K. K. GHAI (*Alternate*)	
SHRI SURINDER NAYYAR	Hansraj Nayyar (Surgical) Private Ltd, Amritsar
DR J. PRASAD	Central Scientific Instruments Organization (CSIR), Chandigarh
SHRI RAM SINGH (*Alternate*)	
SHRI K. N. RAMASWAMY	Directorate General of Technical Development, New Delhi
SHRI P. V. MAMMEN (*Alternate*)	
SHRI C. NARAYANA RAO	The Andhra Scientific Co Ltd, Masulipatam
LT-COL G. S. SIHOTA	Directorate General of Armed Forces Medical Services, Ministry of Defence